

Our Ref.: 3816-15  
72NP06043

# ***U.S. PATENT APPLICATION***

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***Invention:*** TUBE PLATE FOR TUBE BUNDLES FOR CHEMICAL REACTORS AND  
HEAT EXCHANGERS IN GENERAL

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## ***SPECIFICATION***

# TUBE PLATE FOR TUBE BUNDLES FOR CHEMICAL REACTORS AND HEAT EXCHANGERS IN GENERAL

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The present invention relates to a tube plate for tube bundles for chemical reactors and heat exchangers in general.

The present invention can also be applied to petrochemical and refinery reactors.

As is known, chemical reactors consist of containers with large dimensions, inside which chemical reactions take place at a high temperature and a high pressure.

Inside their substantially cylindrical body, these chemical reactors generally have a plurality of tubes, or tube bundles, which can carry out various functions, including assisting heat exchange between the operating fluids.

These tube bundles are installed and kept in an operative position by means of use of tube plates, which in some cases can have large dimensions.

With particular reference to the state of the art, it can be noted that, at present, the tube plates are produced in a single piece, or alternatively in several pieces which are welded together and then finished, for example which are drilled and/or machined.

However, these processing operations cause some significant technical problems which must be faced satisfactorily.

Firstly, in order to carry out these processing operations, particular machine tools are necessary, which have large capacities, large useful dimensions, and high costs.

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In addition, the operations to be carried out for these purposes are such that they require processing times which are often too lengthy for present requirements.

Other problems according to the known art are caused by deformations which are created in the tube plate, as a result of welding shrinkages, in particular in the case of joints which are fully welded.

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Sub 2> The object of the present invention is thus to provide a tube plate for tube bundles for chemical reactors, which eliminates the above-described disadvantages.

A further object of the present invention is to provide a tube plate for tube bundles for chemical reactors, which can be produced quickly and economically.

A further object of the present invention is to provide a tube plate for tube bundles for chemical reactors, which is safe and reliable when it is installed.

These objects and others according to the invention are achieved by a tube plate for tube bundles for chemical reactors, characterised in that it comprises a plurality of components, with a shape which is complementary to one another, in order to form a

complete plate, wherein the said components are produced separately, and are connected to one another subsequently by means of mechanical joints, in order to form the said tube plate.

According to a preferred embodiment of the present invention, the components which form the said tube plate are joined to one another by means of a plurality of mechanical connections, which engage the respective components with one another.

Further characteristics of the tube plate for tube bundles for chemical reactors, according to the present invention, are defined in the other claims attached to the present application.

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In the embodiment illustrated by way of example in the attached figures, the tube plate 10 has two components, 11 and 12, with a substantially semi-circular shape, which have previously been machined.

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It will be appreciated that, according to the present invention, perforated plates can be produced in several pieces or components, according to requirements and to the design dimensions, which are subsequently joined together by means of mechanical joints.

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Thus, a perforated plate with large dimensions is produced in several parts which are connected to one another.

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Sub 10 As described briefly hereinafter, the components of the tube plate, the number of which depends on the dimensions and the structural requirements, are processed until they are completed, and are then connected mechanically. In the example illustrated in the attached figures, the semi-circular components 11 and 12 are joined to one another by means of a plurality of pins 15.

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The pins 15 are inserted in holes provided respectively in the component 12 and in a projecting portion 13 of the component 11.

Sub 11 In fact, the component 11 has a projection 13 which is inserted in a corresponding cavity 14 in the component 12.

The connection of these components 11 and 12 is completed by means of welded connections 16, between the head of the pin 15 and the component 12, and by means of further welded connections 16' between the components 11 and 12.

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However, in addition to the example described, in order to guarantee sealing, seals of any type can be used, or, alternatively, a welding seal can be produced on the mechanical connection parts (which can consist of braces, screws, wedges, cams etc.).

As a result, the invention makes it possible to process separately and in parallel components with smaller dimensions, on machines with smaller dimensions and capacities.

The description provided makes apparent the characteristics and technical advantages of the tube plate for tube bundles for chemical reactors, according to the present invention.

The following considerations and concluding comments are now made, in order to define the said advantages more clearly and accurately.

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The invention avoids the need to use machine tools with large capacities and large useful dimensions, and the time for construction of the manufactured product is reduced.

In addition, there is a drastic reduction in the problems of deformation caused by welding shrinkages, in the case of fully welded joints.

The invention can be applied to chemical reactors, heat exchangers, and in general to tube-bundle type pressure devices.

Finally, it is apparent that many other variations can be made to the tube plate or tube bundles for chemical reactors which is the subject of the present invention, without departing from the principles of novelty which are inherent in the inventive concept.

It is also apparent that, in the practical implementation of the invention, any materials, dimensions and forms can be used according to requirements, and can be replaced by others which are technically equivalent.

In fact, the same results could be obtained with different connection technologies, provided that the novelty of the inventive concepts contained in the present description is applied.

The scope of the present invention is defined by the attached claims.